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ABSTRACT

This technology information packet includes information about the technical aspects of access to technology, legal obligations concerning technology and individuals with disabilities, and a list of resources for further information and assistance. A question and answer section addresses: barriers to educational technology for students with disabilities; how product access for students with disabilities can be delivered; the benefits of access features for typical students; a school's legal responsibilities to provide accessible technology for students with disabilities; a school's legal responsibility to provide accessible technology for employees with disabilities; the state's responsibilities as a recipient of funds made available under the Technology Related Assistance for Individuals with Disabilities Act; how a school knows if educational technology products are fully accessible; and how a school can implement accessibility considerations when purchasing technology. A checklist is provided of access considerations in technology purchases, along with an explanation of computer hardware and software features that affect access for individuals with disabilities. A list of books and newsletters on assistive technology is included. The information packet also includes the U.S. Department of Education's minimum accessibility requirements that software applications must meet in order to be used by all Department employees and customers. (CR)

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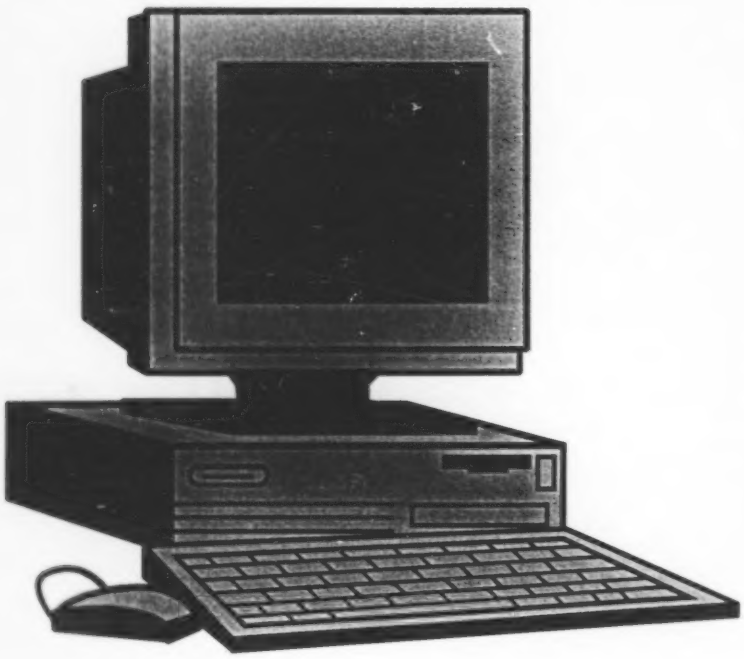
COMPUTER ACCESSIBILITY TECHNOLOGY PACKET

ED 419 355



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Office of Educational Research and Improvement
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October 10, 1997

Dear Colleagues:

I am writing about the importance of having electronic and information technology that is accessible to everyone in schools, including individuals with disabilities.

As you know, President Clinton has made education a top priority for his Administration. One of the President's education initiatives is to bring the power of the information age into all of our schools by connecting every school to the Internet by the year 2000 and by ensuring that every student is technologically literate. Technology enriches education. Children with access to computers and trained teachers can learn faster and learn better. For students with disabilities, technology such as word processing and speech recognition can give them the tools they need to participate fully in challenging academic courses. As the use of technology in all aspects of life has become more prevalent, technology skills have also become a basic requirement, just like reading, writing and math, that every student must master to succeed and be productive. Therefore, it is essential that the technology used in our schools leaves no one behind.

Schools are making large investments in technology as part of their administrative and information systems. In purchasing technology, it is important to incorporate considerations about accessibility for students and employees with disabilities into the decision-making process. It is more cost efficient to consider issues about accessible technology up front, rather than incur the expense of retrofitting or adapting a system or device to make it accessible later.

To assist you as you make decisions about technology purchases, we have enclosed a technical assistance packet that we hope will be helpful. The packet includes information about the technical aspects of access, legal obligations concerning technology and individuals with disabilities, and a list of resources for further information and assistance.

I hope this information will be useful to you.

Yours sincerely,

Richard W. Riley

Enclosure

OVERVIEW

Computer technology allows all learners to expand their ability to gather, manipulate, understand, and use information. In particular, many of the more than five million students with disabilities educated by the Nation's public schools have experienced the benefits of technology through the use of a wide variety of adaptive devices and software tools that assist their effective participation in the classroom. For example, students who are unable to manipulate a keyboard can use computers that respond to voice commands; persons who have low vision or are blind can use personal computers with large print monitors or speech synthesizers to read print text; and children who cannot speak can use devices that provide electronic voices for them. Technology developed within the last several decades has allowed many students with disabilities to overcome what previously would have been significant limitations to educational achievement.

Schools should remain cognizant of their responsibility to provide equal educational opportunity for individuals with disabilities when procuring technology systems for the use of students and staff, particularly multimedia, graphics and graphical interface (such as Windows) applications. Obviously, every computer or piece of technology equipment need not be equipped for use by persons who have disabilities. But overall, technology devices and systems of technology used by students, teachers, or other school employees should be capable of being used, or adapted for use, by individuals with disabilities. It is quite possible to unintentionally construct new barriers when acquiring educational technology systems if schools do not consider accessibility features. In many cases, decisions now being made about the selection of systems configurations, and computer hardware and software will provide the technological infrastructure to be used in schools for years to come. If every school adds consideration of accessibility to its decision-making process when acquiring technology, it will greatly increase the ability of students, teachers, and other individuals with disabilities to participate equally in the information age with their nondisabled peers.

Because public school districts and other educational institutions are prohibited from excluding individuals from programs and activities on the basis of disability, consideration of accessibility in acquiring technology not only makes good fiscal sense, but also helps schools to meet their legal obligations under Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act of 1990, and the Individuals with Disabilities Education Act. Currently, all States receive Federal funds under the Technology-Related Assistance for Individuals with Disabilities Act, which requires the States to purchase and use electronic and information technology that is accessible to individuals with disabilities.

Schools also can use Federal funds for technology purchases from a number of interrelated programs, including the Technology Literacy Challenge Fund, and Titles I and VI of the Elementary and Secondary Education Act. These programs and others are described on the Department's web site (http://www.ed.gov). In addition, the Telecommunications Act of 1996, which provides for reduced rates in services to educational providers and libraries, will significantly lower the costs for telecommunication services, internal networking, and access to the Internet for all schools and libraries.

Schools can help ensure cost-effective access to technology by thinking about the extent to which computer hardware and software and any information technology systems, considered for purchase, allow universal access by all users or are adaptable for use by individuals with disabilities. Persons responsible for making decisions regarding educational technology purchases should be made aware of access issues and existing resources to guide the decision-making process. Because large-scale

technology purchases may typically be undertaken with consultant or contractor support, or with assistance from expert staff working with management information or other technology systems, schools may want to incorporate access issues into standard procurement requirements and make accessibility part of the discussion with staff, consultants, or contractors.

We hope that the questions and answers, checklist, and the references included in this technical assistance packet will help you in your decision-making process.

Copies of this packet may be obtained in an alternate format (e.g., Braille, audiotape, large print or computer diskette) by individuals with disabilities upon request to:

Assistant Secretary Judy Heumann
Office of Special Education and Rehabilitative Services
Department of Education
Mary E. Switzer Building
330 C Street, S.W.
Washington, D.C. 20202

Phone: Voice/TDD: (202) 205-5465

It will also be available on the Department's web site at:

http://www.ed.gov/offices/OSERS/whatsnew/techpack.html

EDUCATIONAL TECHNOLOGY: QUESTIONS AND ANSWERS ON ENSURING ACCESS FOR INDIVIDUALS WITH DISABILITIES

These questions and answers are intended to address areas of interest related to ensuring that technology used in the Nation's schools can effectively be used by students and employees with disabilities. President Clinton has made access to educational technology a primary goal of his Administration. He states, "We know, purely and simply, that every single child must have access to a computer, must understand it, must have access to good software and good teachers and to the Internet, so that every person will have the opportunity to make the most of his or her own life." In helping to make this goal a reality the Department of Education recognizes that technology must be accessible to *all* children. Commitment to free quality education for all is a fundamental principle of our nation, and knowledge of technology is increasingly essential for life and work. We cannot allow some children to have access and leave others out.

1. HOW DO BARRIERS TO EDUCATIONAL TECHNOLOGY ACCESS FOR STUDENTS WITH DISABILITIES DIFFER FROM ACCESS BARRIERS FOR ALL OTHER STUDENTS ?

Common barriers to educational technology access for all students include costs associated with obtaining equipment, difficulty connecting rural locations, lack of funding to train personnel to utilize technology, and so on. For students with disabilities, more basic access barriers are encountered in interacting with the educational technology product. Motor disabilities may limit students' ability to use a standard keyboard, the standard monitor display may not be usable by students with visual impairments, and the speech output of an instructional program may not be understood by students with a hearing impairment. Alternative input and output features are frequently needed by students with disabilities to allow them to interact with the educational technology on an equal basis with other students. Such features are critical for educational technology "product access" just as ramps and lever door handles are critical for building access.

2. HOW CAN "PRODUCT ACCESS" FOR STUDENTS WITH DISABILITIES BE DELIVERED ?

Access for students with disabilities can either be accomplished through built-in features or ones that are added-on to the product. Built-in access features are usually more robust, stable, and cost-effective than add-on. Examples of built-in access features would be keyboard adjustments that allow for sequential rather than simultaneous keystrokes and software that provides the capacity to enlarge the visual display to a variety of sizes. Unfortunately, not all access features are available built-in, and as a result, compatibility with add-on access products will also be necessary to assure full access. Examples of compatibility with add-on access products would be the capacity to accept input from alternative keyboards, software that supports the stable operation of "screen-readers," products that transform visual display into speech with additional software, and speech synthesizers.

As the developers of computer hardware and software recognize the benefit that can be derived from all individuals (those with and without disabilities) being able to use the same computer equipment and software applications, the concept of universal design in the development of new products becomes more accepted and built-in access should become more readily available.

3. DO THESE INPUT AND OUTPUT ALTERNATIVES HELP ONLY STUDENTS WITH DISABILITIES?

No, many access features provide benefits for individuals without disabilities. Just as curb cuts accommodate individuals pushing shopping carts and baby strollers, in addition to providing access for individuals who use wheelchairs, many educational technology access features support students with a variety of learning needs. Alternative input options allow preschool children to use a computer effectively when they do not yet have the motor skills to use a standard keyboard. Voice output systems not only provide access for individuals who cannot see text on a screen display, but also support effective technology use by individuals with limited reading skills. Text display of speech output can foster literacy development and efforts to learn new languages, in addition to providing access for individuals who cannot hear.

4. WHAT ARE A SCHOOL'S LEGAL RESPONSIBILITIES TO PROVIDE ACCESSIBLE TECHNOLOGY FOR STUDENTS WITH DISABILITIES?

The Federal laws that govern a public school's obligation to provide accessible technology for individuals with disabilities all seek to ensure that an individual's disability does not prevent him or her from participating in the school's educational program. A public school, and any other recipient of Federal financial assistance, should look to Section 504 of the Rehabilitation Act of 1973, as amended, (Section 504), 29 U.S.C. § 794, with implementing regulations at 34 CFR Part 104. As a public entity, the responsibilities of a school are also governed by Title II of the Americans with Disabilities Act of 1990 (ADA), 42 U.S.C. § 12101, with implementing regulations at 28 CFR Part 35. In addition, the Individuals with Disabilities Education Act (IDEA), which was recently reauthorized on June 4, 1997 as Public Law No.105-17, and can be found starting at page 37 of Volume 111 of the Statutes at Large, applies to States, public school districts, and other instrumentalities of the State responsible for educating students with disabilities. Its implementing regulations can be found at 34 CFR Part 300. (Please note that these regulations have not yet been amended to reflect the new statute.)

Students with disabilities must have an equal opportunity to participate in and benefit from a school district's programs and activities. If computer technology is part of a public school's education program, Section 504 and Title II of the ADA require a school to provide students with disabilities with accessible computer hardware and software so that they are not excluded from the education program. In addition, the computer hardware must be placed in a location that is accessible to students with disabilities. If technology is purchased that cannot be made accessible, it will have to be retrofitted, replaced, or some other adaptation will have to be made so that students with disabilities can have an equal opportunity to participate in the education program. If equal access to an education program can be provided through other means, a particular technology may not need to be fully accessible to every student. However, technology should be readily available that can provide access for individuals with all types of disabilities. Where technology is the "sole provider" of information or services, for example, an electronic library system or a single station that provides Internet access, it must either be accessible or be able to be made accessible in order to provide students with disabilities with an equal opportunity to participate in the education program.

In addition, the ADA requires public elementary and a secondary school to take appropriate steps to ensure that communication with individuals with disabilities are as effective as communication

with others. Communication in the context of information technology means the transfer of information through computers, including the resources of the Internet. A school is required to provide appropriate auxiliary aids and services where necessary to ensure effective communication for individuals with disabilities. They are also required to make reasonable modifications in policies, practices or procedures when the modifications are necessary to avoid discrimination on the basis of disability. When making purchases and when selecting its resources, a school has a duty to solve barriers to information access that the school's purchasing choices create. Under certain circumstances, a school may not be required to take an action that it can demonstrate would result in a fundamental alteration in the nature of the program or in undue financial and administrative burdens. However, if a school selects software and/or hardware that are not adaptable for access by individuals with disabilities, the subsequent expense of providing access is not counted in determining an undue burden to the extent such cost could have been significantly reduced by considering the issue of accessibility at the time of the initial selection.

If accessible computer technology or a particular assistive technology device or service is necessary for the provision of a free appropriate public education (FAPE) to students with disabilities, Section 504, Title II of the ADA and the IDEA require a school to provide that technology. The undue burden analysis described above does not apply when a student needs technology as a part of his or her entitlement to FAPE. The recent amendments made to IDEA by Pub. L. 105-17 require consideration of a student's need for assistive technology through the individualized education program (IEP) process. Therefore, individualized determinations regarding technology that a student with a disability may need in order to be provided with FAPE must be made through the process used to develop the student's IEP, and decisions made regarding the child's use of technology should be included in the IEP. For students with disabilities not receiving services under the IDEA, but covered under Section 504, a student's need for assistive technology is considered as part of determining the appropriate educational and related services that will be provided to meet the individual educational needs of that student as adequately as the needs of students who are not disabled.

5. WHAT ARE A SCHOOL'S LEGAL RESPONSIBILITIES TO PROVIDE ACCESSIBLE TECHNOLOGY FOR EMPLOYEES WITH DISABILITIES?

As with students, a school must make its technology systems and computer hardware and software accessible where necessary to ensure that it does not discriminate against its employees with disabilities in the terms and conditions of their employment. Section 504, Subpart B contains employment requirements that apply to a public school, and other recipients of Federal financial assistance. Title I and Title II of the ADA contain employment requirements that apply to a public school, regardless of whether it receives Federal financial assistance. (Note that Section 504 has been amended to incorporate the Title I employment standards.) A school cannot discriminate against an employee based on his or her disability, and if job applicants, teachers, and other employees use technology provided by the school, the school must make that technology accessible so that employees with disabilities are not denied opportunities based on their disabilities.

Particular assistive technology or access to standard technology may also be needed by employees with disabilities as a reasonable accommodation. An employer need not provide a

specific accommodation that is requested by an applicant or employee if an alternative means of accommodation that is less costly, but effective, is available. For example, although an individual with low vision may request a large computer monitor that would enable the individual to better view information on the computer screen, there may be situations in which an employer may not have to provide that monitor if a less expensive screen enlargement software can provide the same level of access to on-screen materials for that individual. Also, if an employer can demonstrate that a requested accommodation would impose an undue hardship on the employer, it need not be provided. However, if the originally requested accommodation would impose an undue hardship, the employer must consider carefully whether another accommodation exists that would not result in an undue hardship. These determinations are fact-specific and would have to be made on a case-by-case basis. For further information on these employment requirements, you may want to look at the ADA Title I regulations which are found at 29 CFR Part 1630.

6. WHAT IS A STATE'S RESPONSIBILITY AS A RECIPIENT OF FUNDS MADE AVAILABLE UNDER THE TECHNOLOGY RELATED ASSISTANCE FOR INDIVIDUALS WITH DISABILITIES ACT?

Under the Technology-Related Assistance for Individuals with Disabilities Act of 1988, as amended in 1994 (the Tech Act), the Department of Education provides Federal funding to each State, the District of Columbia, Puerto Rico, and the outlying areas to develop state-wide programs focusing on systemic change and advocacy activities to improve the way individuals with disabilities access assistive technology devices and services. The State, any recipient, and any subrecipient of Federal funds under the Tech Act are required under Section 103 (e) (6) of that Act and 34 CFR §345.31(d) to submit an assurance to the Department that it will comply with guidelines established under Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794d). Guidelines for electronic and information technology accessibility are designed to ensure, regardless of the type of medium, that individuals with disabilities can produce information and data, and have access to information and data, comparable to that of individuals who are not disabled. Guidelines currently being used under Section 508 are found in *Managing Information Resources for Accessibility* issued by the General Services Administration's Center on Information Technology Accommodation.[1] This handbook can be found on GSA's web site at http://www.gsa.gov/coca.

7. HOW CAN A SCHOOL FUND EDUCATIONAL TECHNOLOGY ACCESS FOR STUDENTS WITH DISABILITIES?

Federal funds are currently available to support the purchase of educational technology. These general education technology funds can and should be used to procure accessible educational technology, including technology with built-in access, technology that is compatible with add-on access products, and add-on access products themselves. These Federal funds should not be used to purchase inaccessible technology with the expectation that some "special" funding source has responsibility for making the products accessible. When expending Federal educational

[1] Although this handbook refers to the Federal Information Resources Management Regulations, which were eliminated by Congress in 1996 as part of regulatory reform efforts, it is still being used as guidance.

technology funds, built-in access and compatibility with add-on access products should be considered as a condition for product purchase.

8. HOW DOES A SCHOOL KNOW IF EDUCATIONAL TECHNOLOGY PRODUCTS ARE FULLY ACCESSIBLE?

Although there continue to be discussions in the information technology industry and the Federal government regarding the use of an "access seal" or some other access assurance statement in product marketing material, there is currently no obvious way to determine whether an off-the-shelf technology product is accessible. There are no mandated access requirements that educational technology products must meet prior to becoming available for purchase. Many educational technology products on the market today have not been designed to provide or support full access for individuals with disabilities. There is currently no independent review entity that provides buyers with authoritative information regarding the accessibility of educational or other types of technologies or information on how products compare to each other concerning accessibility.

Information on the accessibility of certain products is available, however, from many of the resources listed in response to Question 10 and from the manufacturers themselves. In addition, when a school is procuring computer hardware and software, as well as entire systems of information technology and equipment, a school needs to add access considerations to the list of factors they use to make decisions about the purchase of educational technology, both for off-the-shelf products and for those systems that will be designed or created for a school's use. The checklists, guides, and resources enclosed and referenced in this technical assistance packet are intended to provide a school with examples of ways to include accessibility in its technology purchasing decisions. Best practice and common sense would advise that a school procure only products that are or can be made fully accessible. The following resources contain information that can be used to conduct a review of educational technology products for accessibility:

- Access Considerations: QuickList and Reference Notes by the Missouri Assistive Technology Project (enclosed). This document provides a checklist of access considerations in technology purchases and an explanation of computer hardware and software features that affect access for individuals with disabilities.

- The U.S. Department of Education's *Requirements for Accessible Software Design* (enclosed). These requirements, adopted into the Department's contracts for software procurement, provide functional specifications that, if included in software design, will ensure minimum accessibility for individuals with disabilities. The requirements can also be found on the Department's web site at

  http://www.ed.gov/offices/OCIO/asstech/assi.html
  or at
  http://gcs.ed.gov.coninfo/clibrary/software.htm.

The proposed *Telecommunications Act Accessibility Guidelines* developed pursuant to Section 255 of the Telecommunications Act of 1996, by the United States Architectural and Transportation Barriers Compliance Board (the Access Board), on April 18, 1997, also provide

an example of how to convey a school's technology accessibility needs to vendors and to procurement personnel. These guidelines include requirements for telecommunications product accessibility that are functionally based and include requirements for compatibility with add-on access products. The proposed guidelines have been issued for public comment. The final version of the guidelines will be published in the *Federal Register* and posted on the Access Board's web site (http://www.access-board.gov/) as soon as the Access Board finishes review of the comments submitted by the public. Another source for accessibility guidelines that can be used in the procurement process is the handbook, *Managing Information Resources for Accessibility* by the General Services Administration's Center on Information Technology Accommodation, which includes sample accessibility clauses for technology procurement contracts, and can be found on GSA's web site (http://www.gsa.gov/coca).

9. HOW CAN A SCHOOL IMPLEMENT ACCESSIBILITY CONSIDERATIONS WHEN PURCHASING?

A number of techniques can be used to ensure that educational technology products or systems provide the accessibility a school needs. Products and/or product specifications can be directly reviewed by school staff. This review can be done by staff who have familiarity with the access standards and may entail pooling the expertise of special educators and educational technology specialists. Community resources and individuals who are users of adaptive technology and are familiar with access features can be asked to assist in product reviews. In addition, vendors can be asked to provide a review of their products in reference to the access standards, to demonstrate how their products conform to the access standards, or if they do not conform, to show how they can be modified or adapted to be made accessible. Asking vendors to review or demonstrate the accessibility of their products provides an added benefit of increasing awareness to access issues that can be addressed by the manufacturer during future product development.

10. WHERE CAN A SCHOOL GET MORE ASSISTANCE?

Provided below are some of the resources that exist to assist a school in addressing the technological and legal issues involved in obtaining and using technology that is accessible to individuals with disabilities.[2]

[2] The information from the organizations listed here, along with other information provided in the technical assistance packet, do not necessarily reflect the views or policies of the Department of Education. Nor does mention of a specific organization, agency, or entity imply endorsement by the Federal government.

ORGANIZATIONS THAT PRIMARILY ADDRESS TECHNOLOGICAL ISSUES

The assistive technology project in each State, established under the Tech Act, can provide a school with information on the purchase and use of accessible technology. Many States also have regional assistive technology resource centers located within the State. To find out if there is a center near you, call your State's Tech Act project. In States where no Information and Referral contact person is listed, the Project Director can assist you.

ALABAMA STATEWIDE TECHNOLOGY ACCESS AND RESPONSE PROJECT (STAR) SYSTEM FOR ALABAMIANS WITH DISABILITIES

2125 East South Boulevard
P.O. Box 20752
Montgomery, AL 36120-0752

Project Director: Dr. Tom Gannaway
Telephone: (334) 613-3480 or (800) STAR656 (In-State only); Fax: (334) 613-3485
INTERNET: http://www.mindspring.com/~alstar
E-mail: alstar@mont.mindspring.com

ASSISTIVE TECHNOLOGIES OF ALASKA

701 E. Tudor Road, Suite 280
Anchorage, AK 99503-7445
Information and Referral: Rose Foster

Telephone: Voice/TDD (907) 563-0138
Program Director: Michael Shiffer
Telephone: Voice/TDD (907) 274-5606;
Fax: (907) 274-5605
INTERNET: http//:www.corcom.com/ata/index.html
E-mail: atadvr@corcom.net

AMERICAN SAMOA ASSISTIVE TECHNOLOGY PROJECT

Division of Vocational Rehabilitation
Department of Human Resources
Pago Pago, American Samoa 96799

Project Director: Edmund Pereira
Telephone: Voice (684) 699-1529; TDD (684) 233-7874; Fax: (684) 699-1376

ARIZONA TECHNOLOGY ACCESS PROGRAM (AZTAP)

Institute for Human Development
Northern Arizona University
P.O. Box 5630
Flagstaff, AZ 86011

Information and Referral: ElizBeth Pifer
Interim Director: Daniel Davidson, Ph.D.
Telephone: Voice (520) 523-7035; TDD: (520) 523-1695; Fax: (520) 523-9127
INTERNET: http://www.nau.edu/~ihd/aztap.html
E-mail: daniel.davidson@nau.edu

ARKANSAS INCREASING CAPABILITIES ACCESS NETWORK

Department of Education
Vocational and Technical Education Division Arkansas Rehabilitation Services
2201 Brookwood Drive, Suite 117
Little Rock, AR 72202

Project Director: Sue Gaskin
Telephone: Voice/TDD (501) 666-8868; Voice/TDD (800) 828-2799 (In-State only);
Fax: (501) 666-5319
INTERNET: http://www.arkansas-ican.org
E-mail: 102503.3602@compuserve.com

CALIFORNIA ASSISTIVE TECHNOLOGY SYSTEM

California Department of Rehabilitation (Lead Agency)
830 K Street, Room 102
Sacramento, CA 95814

Mailing Address:
P.O. Box 944222
Sacramento, CA 94244-2220

Information and Referral: Kent Gregory
Telephone: Voice (800) 390-2699
Project Director: Catherine Campisi
Project Coordinator: Dennis Law
Telephone: Voice/TDD (916) 324-3062; Fax: (916) 323-0914
INTERNET: http://www.catsca.com
E-mail: doroa.ccampisi@hw1.cahwnet.gov

COLORADO ASSISTIVE TECHNOLOGY PROJECT

Rocky Mountain Resource and Training Institute
1391 N. Speer Boulevard, Suite 350
Denver, CO 80204

Information Operator: Judith Volkman
Project Director: Cathy Bodine
Telephone: Voice (303) 534-1027; TDD (303) 534-1063; Fax: (303) 534-1075
E-mail: cathy.bodine@uchsc.edu

CONNECTICUT ASSISTIVE TECHNOLOGY PROJECT

Bureau of Rehabilitation Services
10 Griffin Road North
Windsor, CT 06095

Project Director: John M. Ficarro
Telephone: Voice (860) 298-2014; TDD (860) 298-2018; Fax: (860) 298-9590
INTERNET: http://www.ucc.uconn.edu/~techact/
E-mail: cttap@aol.com

DELAWARE ASSISTIVE TECHNOLOGY INITIATIVE (DATI)

Applied Science & Engineering Laboratories University of Delaware
Dupont Hospital for Children
1600 Rockland Road, Room 154
P.O. BOX 269
Wilmington, DE 19899-0269

Project Director: Beth A. Mineo Mollica, Ph.D.
Telephone: Voice (302) 651-6790; TDD (302) 651-6794; Fax: (302) 651-6793
INTERNET: http://www.asel.udel.edu/dati
E-mail: dati@asel.udel.edu

D.C. PARTNERSHIP FOR ASSISTIVE TECHNOLOGY

801 Pennsylvania Avenue, SE, Suite 300
Washington, D.C. 20003

Information Specialist: Alex Lugo
Project Director: Jody Wildy
Telephone: Voice (202) 546-9163; TDD (202) 546-9168; Fax: (202) 546-9169
E-mail: jodywild@dcpat.org

FLORIDA ALLIANCE FOR ASSISTIVE SERVICE AND TECHNOLOGY

2002-A Old Street Augustine Road
Tallahassee, FL 32399-0696

Project Director: Terry Ward
Telephone: Voice/TDD (904) 487-3278; Fax: (904) 921-7214
E-mail: faast@freenet.scri.fsu.edu

GEORGIA TOOLS FOR LIFE

Division of Rehabilitation Services
2 Peachtree Street, N.W., Suite 35-413
Atlanta, GA 30303-3166

Project Director: Joy Kniskern
Telephone: Voice (404) 657-3084, (800) 578-8665 (in-State only); TDD (404) 657-3085
Fax: (404) 657-3086
E-mail: 102476.1737@compuserve.com

GUAM SYSTEM FOR ASSISTIVE TECHNOLOGY

University Affiliated Program - Developmental Disabilities
House #12 Dean's Circle
University of Guam
UOG Station
Mangilao, Guam 96923

Principal Investigator: Heidi E. Farra-San Nicolas, Ph.D.
Project Director: Ben Servino
Telephone: Voice (671) 735-2493; TDD (671) 734-8378; Fax: (671) 734-5709
E-mail: uapservi@uog.edu

HAWAII ASSISTIVE TECHNOLOGY TRAINING AND SERVICES (HATTS)

414 Kuwili Street, Suite 104
Honolulu, HI 96817

Information and Referral: Judith Clark
Telephone: Voice (808) 532-7114
Project Director: Barbara Fischlowitz-Leong, M.Ed.
Telephone: Voice/TDD (808) 532-7110; Fax: (808) 532-7120
E-mail: bfl@pixi.com

IDAHO ASSISTIVE TECHNOLOGY PROJECT

129 W. Third Street
Moscow, ID 83843

Information and Referral: Michelle Doty
Telephone: Voice (208) 885-3630
Project Director: Ron Seiler
Telephone: Voice/TDD (208) 885-3559; Fax: (208) 885-3628
E-mail: seile861@uidaho.edu

ILLINOIS ASSISTIVE TECHNOLOGY PROJECT

528 S. 5th Street, Suite 100
Springfield, IL 62701

Project Director: Wilhelmina Gunther
Telephone: Voice (217) 522-7985; TDD (217) 522-9966; Fax: (217) 522-8067
E-mail: gunther@midwest.net

INDIANA ATTAIN (ACCESSING TECHNOLOGY THROUGH AWARENESS IN INDIANA) PROJECT

1815 N. Meridian, Suite 200
Indianapolis, IN 46202

Project Manager: Cris Fulford
Telephone: Voice (317) 921-8766 (Marion County), (800) 528-8246 (In State only);
TDD (800) 743-3333, (National); Fax: (317) 921-8774
E-mail: cfulford@vunet.vinu.edu

IOWA PROGRAM FOR ASSISTIVE TECHNOLOGY

Iowa University Affiliated Program
University Hospital School
Iowa City, IA 52242-1011

Information and Referral: Amy Hanna
Telephone: Voice (319) 356-1514
Co-Director: Mary Quigley
Telephone: Voice (319) 356-4402
Telephone: Voice/TDD, (800) 331-3027 (National); Fax: (319) 356-8284
E-mail: mary_quigley@uiowa.edu

ASSISTIVE TECHNOLOGY FOR KANSANS PROJECT

2601 Gabriel
P.O. Box 738
Parsons, KS 67357

Project Director: Charles R. Spellman
Project Coordinator: Sheila Simmons
Telephone:Voice (316) 421-8367 or (800) KAN DO IT; Fax/TDD: (316) 421-0954
E-mail: ssack@parsons.isi.ukans.edu

KENTUCKY ASSISTIVE TECHNOLOGY SERVICES NETWORK

Charles McDowell Rehabilitation Center
8412 Westport Road
Louisville, KY 40242

Information and Referral: Jerry Wheatley
Project Director: J. Chase Forrester
Telephone: Voice (502) 327-0022; TDD (502) 327-9855 or
Voice/TDD (800) 327-5287 (In State only); Fax: (502) 327-9974
INTERNET: http://www.katsnet.org
E-mail: katsnet@iglou.com

LOUISIANA ASSISTIVE TECHNOLOGY ACCESS NETWORK

P.O. Box 14115
Baton Rouge, LA 70898-4115

Executive Director: Julie Nesbit
Telephone: Voice/TDD (504) 925-9500; or Voice/TDD (800) 270-6185; Fax: (504) 925-9560 E-mail: latanstate@aol.com

MAINE CONSUMER INFORMATION AND TECHNOLOGY TRAINING EXCHANGE (MAINE CITE)

Maine CITE Coordinating Center
Education Network of Maine
46 University Drive
Augusta, ME 04330

Project Director: Kathy Powers
Telephone: Voice/TDD (207) 621-3195; Fax: (207) 621-3193
E-mail: kpowers@maine.caps.maine.edu

MARYLAND TECHNOLOGY ASSISTANCE PROGRAM

Governor's Office for Individuals with Disabilities
300 W. Lexington Street, Box 10
Baltimore, MD 21201

Information and Referral: James Corey
Telephone: Voice (800) TECH-TAP
Project Director: Mary Brady, M.S.
Telephone: Voice/TDD (410) 333-4975; Fax: (410) 333-6674
INTERNET: http://www/clark.net/pub/mdtap
E-mail: mdtap@clark.net

MASSACHUSETTS ASSISTIVE TECHNOLOGY PARTNERSHIP

MATP Center
Children's Hospital
1295 Boylston Street, Suite 310
Boston, MA 02115

Information and Referral: Patricia Hill
Telephone: Voice (617) 355-7153 or Voice/TDD (800) 848-8867 (In State only)
Project Director: Judy Brewer
Telephone: Voice (617) 355-6380; TDD (617) 355-7301; Fax: (617) 355-6345
E-mail: brewer_ju@a1.tch.harvard.edu

MICHIGAN TECH 2000

Michigan Assistive Technology Project
3815 West Street Joseph Highway
Lansing, MI 48917-3623

Project Director: Sheryl Avery-Meints
Project Manager: Mary Barnes
Telephone: Voice (517) 334-6502; TDD (517) 334-6499; Fax: (517) 373-0565
E-mail: twistm@mrs.mjc.state.mi.us

MINNESOTA STAR PROGRAM

300 Centennial Building
658 Cedar Street
St. Paul, MN 55155

Executive Director: Rachel Wobschall
Telephone: Voice (612) 296-2771 or (800) 657-3862 (In State only); TDD (612) 296-8478
Fax: (612) 282-6671
INTERNET: http://www.state.mn.us/ebranch/admin/assistivetechnology.html
E-mail: mnstars@edu.gte.net

MISSISSIPPI PROJECT START

P.O. Box 1000
Jackson, MS 39205-1000

Information and Referral: Albert Newsome
Telephone: Voice (601) 987-4872
Project Director: Stephen Power
Telephone: Voice (601) 853-5171;Voice/TDD (800) 852-8328 (In State only);
Fax: (601) 364-2349
E-mail: spower@netdoor.com

MISSOURI ASSISTIVE TECHNOLOGY PROJECT

4731 South Cochise, Suite 114
Independence, MO 64055-6975

Project Director: Diane Golden, Ph.D.
Telephone: Voice (816) 373-5193 or (800) 647-8557 (in-State only); TDD (816) 373-9315
Fax: (816) 373-9314
E-mail: matpmo@qni.com

MONTECH

MUARID, The University of Montana
634 Eddy Avenue
Missoula, MT 59812

Project Director: Peter Leech
Telephone: Voice (800) 732-0323 (National); TDD (406) 243-5676; Fax: (406) 243-4730
E-mail: montech@selway.umt.edu

NEBRASKA ASSISTIVE TECHNOLOGY PROJECT

301 Centennial Mall South
P.O. Box 94987
Lincoln, NE 68509-4987

Information and Referral: Kathryn Kruse
Telephone: Voice/TDD (402) 471-2447
Project Director: Mark Schultz
Telephone: Voice/TDD (402) 471-0735
Telephone: Voice (800) 742-7594 (in-State only); Fax: (402) 471-0117
INTERNET: http://www.nde.state.ne.us/atp/techome.html
E-mail: mschultz@nde4.nde.state.ne.us

NEVADA ASSISTIVE TECHNOLOGY COLLABORATIVE

Rehabilitation Division
Office of Community Based Services
711 South Stewart Street
Carson City, NV 89710

Information and Referral: Todd Butterworth
Project Administrator: Donny Loux
Telephone: Voice (702) 687-4452; TDD (702) 687-3388; Fax: (702) 687-3292
INTERNET: http://www.state.nv.us.80
E-mail: nvreach@powernet.net

NEW HAMPSHIRE TECHNOLOGY PARTNERSHIP PROJECT

Institute on Disability/UAP
#14 Ten Ferry Street
The Concord Center
Concord, NH 03301

Information and Referral: Carol Richards
Telephone: Voice/TDD (603) 224-0630
Project Director: Jan Nisbet
Telephone: Voice (603) 862-4320
Project Coordinator: Marion Pawlek
Telephone: Voice/TDD (603) 224-0630; Fax: (603) 226-0389
E-mail: mjpawlek@christa.unh.edu

NEW JERSEY TECHNOLOGY ASSISTIVE RESOURCE PROGRAM

135 East State Street
CN 398
Trenton, NJ 08625

Project Director: Tim Montagano
Telephone: Voice (609) 292-7498; TDD (800) 382-7765; Fax: (609) 292-8347
E-mail: njdvr@gteens.com

NEW MEXICO TECHNOLOGY ASSISTANCE PROGRAM

435 St. Michael's Drive, Building D
Santa Fe, NM 87503

Information and Referral: Carol Cadena
Telephone: Voice/TDD (800) 866-ABLE
Project Director: Alan Klaus
Telephone: Voice/TDD (505) 827-3532; Fax: (505) 827-3746
E-mail: nmdvrtap@aol.com

NEW YORK STATE TRAID PROJECT

Office of Advocate for Persons with Disabilities
One Empire State Plaza, Suite 1001
Albany, NY 12223-1150

Project Director: Deborah Buck
Telephone: Voice (518) 474-2825; Voice/TDD (800) 522-4369 (In-State only)
TDD (518) 473-4231; Fax: (518) 473-6005
E-mail: d.buck@oapwd.state.ny.us

NORTH CAROLINA ASSISTIVE TECHNOLOGY PROJECT

Department of Human Resources
Division of Vocational Rehabilitation Services
1110 Navaho Drive, Suite 101
Raleigh, NC 27609-7322

Information and Referral Telephone: Voice (800) 852-0042 (National)
Project Director: Ricki Cook
Telephone: Voice/TDD (919) 850-2787; Fax: (919) 850-2792
INTERNET: http://www.mindspring.com/~ncatp
E-mail: rickic@mindspring.com

NORTH DAKOTA INTERAGENCY PROGRAM FOR ASSISTIVE TECHNOLOGY (IPAT)

P.O. Box 743
Cavalier, ND 58220

Director: Judie Lee
Telephone: Voice/TDD (701) 265-4807; Fax: (701) 265-3150
E-mail: lee@pioneer.state.nd.us

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS ASSISTIVE TECHNOLOGY PROJECT

Developmental Disabilities Planning Office
Office of the Governor, Building 1312
P.O. Box 2565
Saipan, MP 96950

Project Director: Thomas J. Camacho
Telephone: Voice/TDD (670) 322-3014; Fax: (670) 322-4168
E-mail: dd.council@saipan.com

OHIO TRAIN

Ohio Super Computer Center
1224 Kinnear Road
Columbus, OH 43212

Information Specialist: Marie Kahl
Telephone: Voice (614) 292-2426
Executive Director: Douglas Huntt
Telephone: Voice (614) 292-2426; Voice/TDD (800) 784-3425 (In State only);
TDD (614) 292-3162; Fax: (614) 292-5866
INTERNET: http://train.ovl.osc.edu
E-mail: dhuntt@mailcar.ovl.osc.edu

OKLAHOMA ABLE TECH

Oklahoma State University Wellness Center
1514 W. Hall of Fame Road
Stillwater, OK 74078-2026

Project Manager: Linda Jaco
Telephone: Voice (405) 744-9864 or (405) 744-9748 or Voice/TDD (800) 257-1705;
Fax: (405) 744-7670
INTERNET: http://www.okstate.edu/wellness/at-home.htm
E-mail: mljwell@okway.okstate.edu

OREGON TECHNOLOGY ACCESS FOR LIFE NEEDS PROJECT (TALN)

1257 Ferry Street, SE
Salem, OR 97310

Project Director: Byron McNaught
Telephone: Voice/TDD (503) 361-1201; Fax: (503) 378-3599
E-mail: ati@orednet.org

PENNSYLVANIA'S INITIATIVE ON ASSISTIVE TECHNOLOGY

Institute on Disabilities/UAP
Ritter Annex 433
Philadelphia, PA 19122

Information and Referral: Lynn Zelvin
Telephone: Voice (215) 204-5966
Project Director: Amy Goldman
Telephone: Voice/TDD (215) 204-5968 or (800) 750-PIAT (TT); Fax: (215) 204-9371
E-mail: piat@astro.ocis.temple.edu

PUERTO RICO ASSISTIVE TECHNOLOGY PROJECT

University of Puerto Rico
Medical Sciences Campus
College of Related Health Professions
Office of Project Investigation and Development
Box 365067
San Juan, PR 00936-5067

Project Director: Maria I. Miranda, B.A.
Telephone: Voice (809) 758-2525 x4413 or (800) 496-6035 (From U.S. only) or
(800) 981-6033 (In PR only); TDD/Fax: (809) 754-8034
E-mail: pratp@rcmad.upr.clu.edu

RHODE ISLAND ASSISTIVE TECHNOLOGY ACCESS PROJECT

Office of Rehabilitation Services
40 Fountain Street
Providence, RI 02903-1898

Project Director: Susan Olson
Telephone: Voice (401) 421-7005 or (800) 752-8088 ext.2608 (In State only);
TDD (401) 421-7016; Fax: (401) 274-1920
INTERNET: http://www.ors.state.ri.us.
E-mail: ab195@osfn.rhilinet.gov

SOUTH CAROLINA ASSISTIVE TECHNOLOGY PROGRAM

USC School of Medicine
Center for Developmental Disabilities
Columbia, SC 29208

Project Director: Evelyn Evans
Telephone: Voice (803) 935-5240
Telephone: Voice/TDD (803) 935-5263; Fax: (803) 935-5342
INTERNET: http://www.cdd.sc.edu/scatp/scatp.htm
E-mail: scatp@scsn.net

SOUTH DAKOTA ASSISTIVE TECHNOLOGY PROJECT (DAKOTALINK)

1925 Plaza Boulevard
Rapid City, SD 57702

Project Director: Ron Reed, Ph.D
Telephone: Voice (605) 394-1876 or (800) 645-0673 (In State only); Fax: (605) 394-5315
INTERNET: http://www.tie.net/dakotalink
E-mail: rreed@sdtie.sdserv.org

TENNESSEE TECHNOLOGY ACCESS PROJECT

710 James Robertson Parkway
Andrew Johnson Tower, 10th Floor
Nashville, TN 37243-0675

Information and Referral: Anastasia Koshakji
Project Director: Rob Roberts, Ph.D.
Telephone: Voice (615) 532-6558 or (800) 732-5059 (In State only); TDD (615) 741-4566;
Fax: (615) 532-6719
E-mail: rroberts2@mail.state.tn.us

TEXAS ASSISTIVE TECHNOLOGY PARTNERSHIP

University of Texas at Austin
College of Education
SZ8252-D5100
Austin, TX 78712-1290

Information and Referral: John Moore
Telephone: Voice (800) 828-7839
Interim Project Director: Susanne Elrod
Telephone Voice (512) 471-7621; TDD (512) 471-1844; Fax: (512) 471-7549
INTERNET: http://www.edb.utexas.edu/coe/depts/sped/tatp/tatp.html
E-mail: s.elrod@mail.utexas.edu

U.S. VIRGIN ISLAND TECHNOLOGY-RELATED ASSISTANCE FOR INDIVIDUALS WITH DISABILITIES (TRAID)

University of the Virgin Islands/UAP
#2 John Brewers Bay
St. Thomas, VI 00801-0990

Executive Director: Dr. Yegin Habteyes
Telephone: Voice (809) 693-1323; Fax: (809) 693-1325
E-mail: yhabtey@gecko.uvi.edu

UTAH ASSISTIVE TECHNOLOGY PROGRAM

Center for Persons with Disabilities
UMC 6855
Logan, UT 84322-6855

Project Director: Marvin Fifield, Ed.D.
Telephone: Voice (801) 797-1982 or (801) 797-3824; TDD (801) 797-2096;
Fax: (801) 797-2355
E-mail: sharon@cpo2.usu.edu

VERMONT ASSISTIVE TECHNOLOGY PROJECT

103 South Main Street
Weeks Building, First Floor
Waterbury, VT 05671-2305

Project Director: Lynne Cleveland
Telephone: Voice/TDD (802) 241-2620; Fax: (802) 241-3052
INTERNET: http://www.uvm.edu/~uapvt/cats.html
E-mail: lynnec@dad.state.vt.us

VIRGINIA ASSISTIVE TECHNOLOGY SYSTEM

8004 Franklin Farms Drive
P.O. Box K300
Richmond, VA 23288-0300

Information and Referral: Maureen Kelly-Olson
Telephone: Voice (757) 552-5019
Project Director: Kenneth Knorr
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E-mail: vatskhk@aol.com

WASHINGTON ASSISTIVE TECHNOLOGY ALLIANCE

DSHS/DVR
P.O. Box 45340
Olympia, WA 98504-5340

Project Director: Debbie Cook
Telephone: Voice (206) 685-4181
Telephone: Voice (360) 438-8000; TDD (360) 438-8644; Fax: (360) 438-8007
INTERNET: http:/weber.u.washington.edu/~atrc
E- mail: debcook@u.washington.edu

WEST VIRGINIA ASSISTIVE TECHNOLOGY SYSTEM

University Affiliated Center for Developmental Disabilities
Airport Research and Office Park
955 Hartman Run Road
Morgantown, WV 26505

Project Manager: Jack Stewart
Telephone: Voice/TDD (304) 293-4692 or Voice (800) 841-8436 (In State only);
Fax: (304) 293-7294
E-mail: stewiat@wvnvm.wvnet.edu

WISTECH

Division of Supportive Living
2917 International Lane, 3rd Floor
Madison, WI 53704

Project Director: Susan Kidder
Telephone: Voice (608) 243-5675
Telephone: Voice/TDD (608) 243-5674; Fax: (608) 243-5681
E-mail: kiddersb@mail.state.wi.us

WYOMING'S NEW OPTIONS IN TECHNOLOGY (WYNOT)

P.O. Box 4298
Laramie, WY 82071-4298

Co-Project Director: Kirk McKinney
Telephone: Voice (307) 777-6947
Co-Project Director: Thomas McVeigh
Telephone: Voice (307) 766-2764
Telephone: Voice/TDD (307) 777-4386 or 777-7450; Fax: (307) 777-5939
INTERNET: http://www.uwyo.edu/hs/wind/wynot/wynot.htm
E-mail: kmckin@missc.state.wy.us

There are also resources to be found at the national level through Federal agencies, disability advocacy organizations, and Federal grant and contract projects.

U.S. DEPARTMENT OF EDUCATION

Office of Special Education and Rehabilitative Services
National Institute on Disability Rehabilitation and Research (NIDRR)
Mary E. Switzer Building
330 C Street, S.W.
Washington, DC 20202

Director: Katherine D. Seelman, Ph.D.
Program Manager, Assistive Technology Programs: Carol Cohen
Telephone: Voice (202) 205-8134; TDD (202) 205-5479; Fax: (202) 205-8997
INTERNET: http://www.ed.gov/offices/OSERS/NIDRR/
E-mail: carol_cohen@ed.gov

GENERAL SERVICES ADMINISTRATION

Information Technology Service
Center for Information Technology Accommodation (CITA)
PWA Room 1234
18th & F Street, N.W.
Washington, DC 20405

Director: Susan Brummel
Telephone: Voice (202) 501-4906; TDD (202) 501-2010; Fax: (202) 501-6269
INTERNET: http://www.gsa.gov/coca

UNITED STATES ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD (ACCESS BOARD)

1331 F Street, N.W., Suite 1000
Washington, DC 20004-1111

Telephone: Voice 1-800-USA-ABLE (1-800-872-2253) or 202-272-5434; TDD 1-800-993-2822 or 202-272-5449; Fax: 202-272-5447
INTERNET: http://www.access-board.gov

ABLEDATA DATABASE PROGRAM

Macro International
8455 Colesville Road, Suite 935
Silver Spring, MD 20910-3319

Principal Investigator: Lynn Halverson
Contact: Katherine Belknap
Telephone: Voice/TDD (800) 227-0216 or Voice/TDD (301) 608-8998, TDD (301) 608-8912; (ABLE INFORM BBS) (301) 589-3563; Fax: (301) 608-8958
INTERNET: http://www.abledata.com
E-mail: abledata@macroint.com

ADAPTIVE ENVIRONMENTS CENTER

374 Congress Street, Suite 38
Boston, MA 02210

Director: Elaine Ostroff
Telephone: Voice/TDD (617) 695-1225; Fax: (617) 482-8099
INTERNET: http://www.adaptenv.org
E-mail: csabatier@adaptenv.org

THE NATIONAL CENTER FOR THE DISSEMINATION OF DISABILITY RESEARCH

Southwest Educational Development Laboratory
211 East Seventh Street, Suite 400
Austin, Texas 78701-3281

Telephone: Voice 1-800-266-1832 or Voice/TDD (512) 476-6861; Fax: (512) 476-2286
INTERNET: http://www.ncddr.org
http://www.ncddr.org/ResearchExchange/v02n01/welcome.html (for information on ensuring accessibility of World Wide Web pages)
E-mail: jwestbro@sedl.org

NATIONAL REHABILITATION INFORMATION CENTER (NARIC)

KRA Corporation
8455 Colesville Road, Suite 935
Silver Spring, MD 20910-3319

Principal Investigator: Mark Odum
Contact: Information Specialists
Telephone: Voice (800) 346-2742 or Voice (301) 588-9284, TDD (301) 495-5626;
Fax: (301) 587-1967
INTERNET: http://www.naric.com/naric
E-mail: odum@kra.com

NATIONAL SCHOOL BOARDS ASSOCIATION

Institute for the Transfer of Technology to Education
1680 Duke Street
Alexandria, VA 22314

Telephone: Voice (703) 838-6722; Fax: 703-683-7590
INTERNET: http://www.nsba.org/itte

REHABILITATION ENGINEERING AND ASSISTIVE TECHNOLOGY SOCIETY OF NORTH AMERICA

RESNA Technical Assistance Project
1700 N. Moore Street, Suite 1540
Arlington, VA 22209

Telephone: Voice (703) 524-6686; TDD (703) 524-6639; Fax: (703) 524-6630
INTERNET: http://www.resna.org/resna
E-mail: resnata@resna.org

REHABILITATION ENGINEERING RESEARCH CENTER ON UNIVERSAL TELECOMMUNICATIONS ACCESS

Gallaudet University
Technology Assessment Program
800 Florida Avenue, N.E.
Washington, DC 20002

Principal Investigator: Judith Harkins, PhD (Gallaudet); Gregg Vanderheiden, PhD (Trace); Deborah Kaplan, LLD (WID)
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TRACE RESEARCH AND DEVELOPMENT CENTER

University of Wisconsin-Madison
S-151 Waisman Center
1500 Highland Avenue
Madison, WI 53705-2280

Principal Investigator: Gregg C. Vanderheiden, PhD
Contact: Rachel Bower
Telephone: Voice (608) 262-6966; TDD (608) 263-5408; Fax: (608) 262-8848
INTERNET: http://www.trace.wisc.edu
E-mail: gv@trace.wisc.edu

UNITED CEREBRAL PALSY ASSOCIATIONS

Assistive Technology Funding and Systems Change Project
1660 L Street, NW, Suite 700
Washington, DC 20036

Project Executive: Michael Morris
Project Director: Susan Goodman
Telephone: Voice/TDD (202) 776-0406; Fax: (202) 776-0414
INTERNET: http://www.ucpa.org/html/innovative/atfsc_index.html
E-mail: gyoung@ucpa.org

ORGANIZATIONS THAT PRIMARILY ADDRESS LEGAL ISSUES

U.S. DEPARTMENT OF EDUCATION

OFFICE FOR CIVIL RIGHTS - REGIONAL OFFICES

EASTERN DIVISION

CONNECTICUT, MAINE, MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT

Office for Civil Rights, Boston Office
U.S. Department of Education
J. W. McCormack Post Office and Courthouse
Room 222, 01-0061
Boston, MA 02109-4557
Telephone: Voice (617) 223-9662; TDD (617) 223-9695; Fax: (617) 223-9669

NEW JERSEY, NEW YORK, PUERTO RICO, VIRGIN ISLANDS

Office for Civil Rights, New York Office
U.S. Department of Education
75 Park Place, 14th Floor
New York, NY 10007-2146

Telephone: Voice (212) 637-6466; TDD (212) 637-0478; Fax: (212) 264-3803

DELAWARE, MARYLAND, KENTUCKY, PENNSYLVANIA, WEST VIRGINIA

Office for Civil Rights, Philadelphia Office
U.S. Department of Education
3535 Market Street, Room 6300, 03-2010
Philadelphia, PA 19104-3326
Telephone: Voice (215) 596-6787; TDD (215) 596-6794; Fax: (215) 596-4862

SOUTHERN DIVISION

ALABAMA, FLORIDA, GEORGIA, SOUTH CAROLINA, TENNESSEE

Office for Civil Rights, Atlanta Office
U.S. Department of Education
61 Forsyth Street, S.W., Suite 19T70
Atlanta, GA 30303
Telephone: Voice (404) 562-6350; TDD (404) 562-6454; Fax: (404) 562-6455

ARKANSAS, LOUISIANA, MISSISSIPPI, OKLAHOMA, TEXAS

Office for Civil Rights, Dallas Office
U.S. Department of Education
1200 Main Tower Building,
Suite 2260, 06-5010
Dallas, TX 75202-9998
Telephone: Voice (214) 767-3959; TDD (214) 767-3639; Fax: (214) 767-6509

NORTH CAROLINA, VIRGINA, WASHINGTON, DC

Office for Civil Rights, District of Columbia Office
U.S. Department of Education
1100 Pennsylvania Ave, N.W., Room 316
P.O. Box 14620
Washington, DC 20044-4620
Telephone: Voice (202)208-2545; TDD (202) 208-7741; Fax: (202) 208-7797

MIDWESTERN DIVISION

ILLINOIS, INDIANA, MICHIGAN, MINNESOTA, OHIO, WISCONSIN

Office for Civil Rights, Chicago Office
U.S. Department of Education
111 North Canal Street, Suite 1053
Chicago, IL 60606-7204
Telephone: Voice (312) 886-8434; TDD (312) 353-2540; Fax: (312) 353-4888

MICHIGAN, OHIO

Office for Civil Rights, Cleveland Office
U.S. Department of Education
600 Superior Avenue East
Bank One Center, Room 750
Cleveland, OH 44114-2611
Telephone: Voice (216) 522-4970; TDD (216) 522-4944; Fax: (216) 522-2573

IOWA, KANSAS, MISSOURI, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA

Office for Civil Rights, Kansas City Office
U.S. Department of Education
10220 North Executive Hills Boulevard
8th Floor, 07-6010
Kansas City, MO 64153-1367
Telephone: Voice (816)880-4202; TDD (816) 891-0582; Fax: (816) 891-0644

WESTERN DIVISION

ARIZONA, COLORADO, MONTANA, NEW MEXICO, UTAH, WYOMING

Office for Civil Rights, Denver Office
U.S. Department of Education
Federal Building, Suite 310, 08-7010
1244 Speer Boulevard
Denver, CO 80204-3582
Telephone: Voice (303) 844-5695; TDD (303) 844-3417; Fax: (303) 844-4303

CALIFORNIA

Office for Civil Rights, San Francisco Office
U.S. Department of Education
Old Federal Building
50 United Nations Plaza, Room 239
San Francisco, CA 94102-4102
Telephone: Voice (415) 437-7700; TDD (415) 437-7786; Fax: (415) 437-7783

ALASKA, HAWAII, IDAHO, NEVADA, OREGON, WASHINGTON, AMERICAN SAMOA, GUAM, TRUST TERRITORY OF THE PACIFIC ISLANDS

Office for Civil Rights, Seattle Office
U.S. Department of Education
915 Second Avenue, Room 3310, 10-9010
Seattle, WA 98174-1099
Telephone: Voice (206) 220-7880; TDD (206) 220-7907; Fax: (206) 220-7887

ACCESS CONSIDERATIONS QUICKLIST

1.0 BASIC SYSTEM ACCESS

Rate each as Limited, Adequate, or Substantial

1.1 What is the memory capacity of the system to efficiently operate current and projected hardware and software including adaptations? Substantial access would include memory needed to run standard applications plus additional memory needed to accommodate adaptations.

1.2 What is the processing capacity of the system to efficiently operate current and projected hardware and software adaptations? Substantial access would include processing speed needed to run standard applications plus additional memory needed to accommodate adaptations.

1.3 What is the capacity of the architecture of the system to allow for expansion, such as the addition of specialized cards, memory chips, and port connections? Substantial access would include the availability of open ports, slots, etc. to meet adaptation needs.

1.4 What is the capacity of the architecture of the system to allow for ease of physical access to features such as on/off switches, volume, contrast, brightness controls, and disk/CD-ROM drives? Substantial access would include controls on the front of the system or accessible from the control panel.

1.5 What is the capacity of the individual user station in a network system to provide adaptations, both built-in and add-on access features? Substantial access would include network ability to deliver adaptations from the server and independently through the end unit.

1.6 What is the capacity of the cabling system to transmit a variety of electronic information? Substantial access would include cabling able to deliver multiple types of electronic information, e.g. adaptations of visual information to auditory and auditory to visual.

2.0 INPUT ACCESS (Operating System, User Application, & Instructional Software)

Rate each as Limited, Adequate, or Substantial

2.1 What is the capacity of the operating system, application and/or instructional software to deliver keyboard and mouse adjustments, internally or as an add-on? Substantial access would include:

- execution of multiple keystroke commands sequentially rather than simultaneously
- adjustment of acceptance rate for keystrokes and keyboard repeat feature
- adjustment of mouse features (click speed, latching)
- delivery of mouse or pointing device input via keyboard commands

- ➢ visual indication of system warning beep
- ➢ visual and auditory indication of toggle keys' status
- ➢ carryover of all operating system adjustments into applications and/or instructional software

2.2 What is the capacity of the operating system, user application, and/or instructional software to accept input from alternative keyboards and alternative pointing devices? Substantial access would be efficient utilization of alternative input devices to transmit any valid input available from the standard keyboard and mouse.

2.3 What is the capacity of the operating system, user application, and/or instructional software to accept input from a voice dictation system? Substantial access would be efficient utilization of speech input to transmit any valid input from the standard keyboard and mouse with effective user control.

3.0 OUTPUT ACCESS (Operating System, User Application, & Instructional Software)

Rate each as Limited, Adequate, or Substantial

3.1 What is the capacity of the operating system, user application and/or instructional software to deliver monitor display adjustments, internally or as an add-on? Substantial access would include:

- ➢ user definable font, size and screen elements such as menu titles, icons, and cursor track
- ➢ user definable color/contrast
- ➢ on and off toggle of adjustment features
- ➢ carryover of all operating system adjustments into applications and/or instructional software

3.2 What is the capacity of the operating system, user application, and/or instructional software to provide visual information, text and other visual images, through speech output?

Substantial access would include:

- ➢ conversion of all critical visual information, text and other visual images, to speech
- ➢ support of and compatibility with the user control features of speech output systems such as; user definable rate, volume and pronunciation of speech output, and user control of visual information to be "read" via pre-set and user defined parameters

- on and off toggle of speech

3.3 What is the capacity of the operating system, user application, and/or instructional software to provide visual information, text and other visual images, through tactile output?

Substantial access would include:

- conversion of all critical visual information, text and other visual images, to tactile
- user control of visual information converted to tactile output via pre-set and user defined parameters

3.4 What is the capacity of the operating system, user application, and/or instructional software to provide auditory information, speech or other sound signals, through enhanced output and visual display? Substantial access would include:

- user definable volume and availability of audio output options (direct input to personal amplification)
- conversion of all critical auditory information to text, graphics, etc., as appropriate for user literacy
- on and off toggle of visual display (such as text captioning)

3.5 What is the capacity of the application and/or instructional software to provide adjusted and alternative hard copy output such as enlarged, enhanced, and spatially manipulated print and images, and braille or other tactile imaging? Substantial access would include:

- adjustment mechanism (font type/size) that enables enlargement/enhancement of text hard copy
- capacity to manipulate the spacial layout of text and graphics to produce adapted hard copy
- capacity to save text in ASCII (text file) to support conversion of text to braille

4.0 RELATED ACCESS

Rate each as Limited, Adequate, or Substantial

4.1 What is the capacity of the system to provide documentation or associated materials in accessible form? Substantial access would be the availability of all associated materials in alternative formats such as braille, text-file, audio-cassette, large print, etc.

4.2 What is the physical accessibility of buildings and rooms in which computer systems are located, including buildings and rooms that are electronically "connected"? Substantial access would be the location of computer systems in fully accessible (ADAAG) facilities.

4.3 What is the physical accessibility of end user structures such as computer stations, desks, tables, etc. and the accessibility of adaptations that are not permanently fixed to a particular computer station? Substantial access would include availability of physical structures that can meet the needs of students with disabilities and ready access (within the general area rather than in another building) to the adaptations needed for a particular student.

4.4 What is the capacity of hardware and software product vendors to provide initial and on-going technical support regarding system access for students with disabilities? Substantial access would be availability of vendor support to assist with operation of built-in access features specific to their product and to assist with operation of their product with add-on access systems.

NOTE:

The considerations on the QuickList apply only to accessibility and are certainly not all of the issues that should be considered prior to technology purchase. Additional, non-access issues should be considered when reviewing instructional software such as: "How well does the instructional software match the curriculum and instructional objectives?" "How motivating and age appropriate is the instructional software? "Can the instructional software be used independently or does it require substantial teacher support?" Educators are encouraged to augment the QuickList review for accessibility with other checklists that assist in selecting quality instructional software to meet the unique learning needs of their students.

For further information please contact:

MISSOURI ASSISTIVE TECHNOLOGY PROJECT

4731 South Cochise, Suite 114
Independence, MO 64055
800/647-8557 (Voice)
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matpmo@qni.com

MISSOURI TECHNOLOGY CENTER FOR SPECIAL EDUCATION

UMKC, School of Education, Room 24
5100 Rockhill Road
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The Reference Notes provide procurement information to assure that the computer systems purchased provide access for students with disabilities. Those purchasing computer hardware for schools are usually familiar with the basic system necessary to meet the current and projected instructional and administrative application needs. The QuickList and the following Reference Notes provide the information necessary to purchase computer equipment that can be made accessible for students with disabilities.

All of a district's computer systems do not require the same configuration nor do they all need to provide every access feature discussed in the QuickList. One system may address access issues for students with physical disabilities while another addresses the needs of students with low vision. The computer needs of students with disabilities are unique to each student and the need is for computer systems which provide options for several accommodations and adaptations.

The goal is to strive for universal access which refers to the design of products, such as computers, with an eye to provide the greatest accessibility with or without modification to the basic product. An example of universal computer access is a feature called StickyKeys which allows a typist to input information through the keyboard in a sequential rather than simultaneous fashion, allowing one-handed typists and others with physical disabilities to use a standard keyboard. This accessibility feature is not always active but can be very easily activated by the students who need the feature.

Accessibility features may be built into computer systems or may be delivered by "add-on" peripherals and/or software. With both built-in or add-on features, it is critical to assure that the feature works with both the operating system and the applications (instructional software programs) which will be used.

Built-in access features offer a higher probability of being more robust, stable, cost-effective and compatible with operating systems and applications (instructional software programs) than add-on features. However, not all access features are available as built-in features and obtaining an add-on may be necessary. Add-on access features may not be an option in a network system with "dumb" terminals since the end units do not have their own processing capability needed to support the add-on feature.

An increased number of built-in access features for all computer platforms has occurred over a span of several years. In the following sections there are statements regarding built-in access features. These statements are based on the features built in to the current generation of computer operating systems: Macintosh 7.x or Windows 3.1 or later. The QuickList and the following Reference Notes are not intended to apply to older versions of these operating systems.

1.0 BASIC SYSTEM ACCESS

The following describes a minimum configuration of most systems sold on today's market.

- 486 processor running at 75 megahertz
- SVGA 256 Color video card
- 16 MB of RAM
- 1.4 MB 3.5" floppy disk drive
- 256 K of Cache memory
- Mouse
- 220 MB of free space on HD

Quad speed CD-ROM Drive

Much of the discussion regarding "limited," "adequate," and "substantial" access is based on the capability of a system with this configuration.

1.1 MEMORY CAPACITY

New computer systems currently come with 16 MB of RAM and 1 to 2 GB of hard disk space. This configuration would be "adequate" to use the majority of built-in adaptations. Thirty-two MB and above would be considered "substantial" and would provide the memory necessary to run the majority of add-on adaptations. Currently a 16 MB memory chip costs $10.00 per chip and can easily be installed if internal memory slots are available.

A rule of thumb is to purchase twice as much memory as you need to run 90% of your instructional software. This same rule of thumb can be applied for the purchase of add-on adaptations. If 90% of the instructional software and add-on adaptations require 16 MB of RAM, purchase computers with at least double that amount.

1.2 PROCESSING CAPACITY

The greater the processing speed, the faster the maneuverability of software and adaptations. Older speeds of 66 megahertz and lower will not provide the performance needed by the majority of software and add-on adaptations. A 486 processor running at 75 megahertz would be considered "adequate" for most adaptations. New computers with Pentium processors running at 100 megahertz would be considered "substantial."

1.3 PERIPHERAL EXPANSION OPTIONS

Computer peripherals, be they standard or adaptive, are connected through established ports. Having only enough ports for the standard peripherals provides "limited" access. A computer system with additional ports or expansion slots available would provide "substantial" access.

Adapted computer peripherals such as an enlarged monitor, which uses the resources of the video card can be attached through an available port. There are differences in how enlarged monitors deal with video information and either a VGA or SVGA card will provide "adequate" access. "Substantial" access would be provided if a student had the choice of which video card to use dependent upon their unique needs.

Built-in audio cards and internal speakers typically deliver operating system, application, and instructional software sounds and speech. To adapt the audio output of the standard system an audio or headset output jack is needed. "Substantial" access would include the availability of an audio/headset output jack to allow for a hearing aid or other amplification device to be coupled directly to the computer sound source. This direct connection allows for amplification of the sound signal and reduces competing noise level.

1.4 PHYSICAL STRUCTURE

On/off switches and controls with a concave surface which require 100 grams or less of pressure to use and which are located on the front of the computer provide the easiest access. Most of

these controls (monitor brightness/contrast and volume) are now available through the built-in features of the control panel. On/off switches and controls on the back of the computer provide "limited" access. A system with the on/off switch on the front and with the other features controlled through the control panel provides "substantial" access.

Disk drives with concave access buttons and which eject at least 3/4" to 1" of the media beyond the housing provide "adequate" to "substantial" access. Drives with twist button closure provide "limited" access. External CD-ROM players, because they can be positioned to meet unique needs, provide greater accessibility and are generally easier for students with physical disabilities to use.

1.5 NETWORKS

Many educational units utilize Local Area Networks (LANs) to network their computer system capacity. Most built-in adaptations can be used at individual workstations since they are part of the operating system. It is much less clear to what extent add-on adaptations which must be loaded onto the server and then delivered to a specific individual unit are available in a standard LAN arrangement. If an adaptation requires extra peripherals, such as a speech synthesizer, these will need to be supported and delivered by the end unit. "Substantial" features in a network system include the ability of the server to deliver built-in and add-on software adaptations to individual end units; the ability of the end units to access, control, set-up, save, and toggle on/off adjustments in applications delivered by the server; and the ability to add adaptations to the end unit that cannot be delivered by the server.

1.6 CABLING

The system's cabling capacity must address current and projected needs. The computer has become the ramp to the information superhighway and the cabling installed will, in all probability, be used for telephone, e-mail, and Internet access.

Use only Ethernet or other high-speed networking systems to gain "adequate" to "substantial" access. LocalTalk or other low-cost networking systems provide "limited" access because they are too slow except for small computer clusters or for printer sharing. While more expensive than Category 3 wiring, Category 5 wiring with Ethernet is recommended as it will not need to be replaced to provide access to a faster network.

For cost efficiency, pull additional runs for network cable from the lab to each classroom. Approximately 65% of the investment made in wiring is for labor, the rest is for the cable. It costs no more in labor to run four network cables into a classroom than to run two. The extra cable will allow for cost efficient expansion and will provide a back-up if the cabling becomes damaged. (Contact the MOREnet Reference Desk for additional information at 573-884-7200.)

2.0 INPUT ACCESS (Operating System, User Applications, Instructional Software)

Input access refers to the ability of built-in and add-on adaptations to make all components (hardware, operating system, applications) accessible to all individuals using the system. Because the design of the standard input devices (keyboard and mouse) require physical mobility

and accuracy for input, people with physical disabilities face the greatest array of access barriers during the input process.

"Adequate" access includes the ready availability of the built-in and add-on keyboard and mouse adjustments listed in the QuickList Section 2.1 plus the availability of adding a serial port. "Substantial" access includes the ready availability of the built-in or add-on keyboard and mouse adjustments described in QuickList Section 2.1 and the availability of an open serial port needed to attach alternative keyboards and pointing devices.

2.1 KEYBOARD AND MOUSE ADJUSTMENTS

Many of the keyboard and mouse modifications needed by students are now available through built-in or add-on system software utilities. "Adequate" to "substantial" access can be provided through the procurement of a newer system which has the features listed below already built into the system or through the acquisition of free add-on software.

AccessDOS and Access Pack (Windows 3.1 version) are free software programs which modify the keyboard and mouse pointer for the DOS and Windows 3.1 environments. The Macintosh System 7.x and Windows 95 include the built-in Easy Access control panels which provide the resources needed to modify the keyboard and mouse pointer.

The operating system adjustments discussed in this section may not carry-over to all applications and instructional software. If the adjustments are not carry-over functions, the application/instructional software must provide such adjustments themselves to provide "substantial" access.

Execution of multiple keystroke commands sequentially rather than simultaneously.
- Built-in for Windows95 and Macintosh System 7.
- Add-on for Windows3.1.

Adjustment of acceptance rate for keystrokes and keyboard repeat feature.
- Built-in for Windows95 and Macintosh System 7.
- Add-on for Windows3.1.

Adjustment of mouse features (click speed, latching).
- Built-in for Windows95 and Macintosh System 7.
- Add-on for Windows3.1.

Delivery of mouse or pointing device input via keyboard commands.
- Built-in for Windows95 and Macintosh System 7.
- Add-on for Windows3.1.

Visual indication of system warning beep.
- Built-in for Windows95 and Macintosh System 7.
- Add-on for Windows3.1.

Visual and auditory indication of toggle keys status.

- Built-in for Windows95 and Macintosh System 7.
- Add-on for Windows3.1.

2.2 ALTERNATIVE KEYBOARDS AND POINTING DEVICES

Alternative keyboard and pointing devices include head pointers, programmable keyboards, switches, and augmentative communication devices. These devices now comply with standard mouse and keyboard input specifications. "Adequate" to "substantial" access would require an available port and the built-in SerialKeys feature.

The operating system adjustments discussed in this section may not carry-over into all applications and instructional software.

2.3 SPEECH INPUT

An add-on voice dictation system, which allows input through speech, may be required for students who cannot access the computer through any other method. Voice dictation systems are generally memory intensive and special consideration should be given to the unique memory requirements of the program being considered in addition to any other memory requirements. "Substantial" access would require ample RAM memory and hard drive space.

Unlike keyboard and mouse adjustments and alternatives, operating system and application compatibility with and support of voice dictations systems is not consistent. It is critical that both the operating system and application software be capable of accepting input from voice dictation systems such as DragonDictate (DOS or Windows), Kurzweil Voice (Windows), IBM VoiceType Dictation (Windows or OS/2), or Articulate Power Secretary (Macintosh). These products are designed for maximum compatibility with applications that conform to operating system standards; however, not all programmers adhere to these system standards resulting in applications which will not work efficiently with voice dictation systems.

3.0 OUTPUT ACCESS (Operating System, User Applications, Instructional Software)

Output access refers to the ability of built-in and add-on adaptations to make all components (hardware, operating system, applications) of a computer system accessible to an individual's use. Because the method of computer output requires visual (monitor or printer) or auditory (system beeps) signals, people with sensory disabilities face the greatest array of access barriers during the output process.

Adapting visual output (monitor or printer) requires the visual information to be enlarged or transformed to another mode, such as speech or tactile. Adapting auditory output (system sounds) requires information to be presented through a visual mode. "Adequate" to "substantial" access would involve the ability to provide these alternative modes of output.

3.1 VISUAL DISPLAY OUTPUT ADJUSTMENTS

Most of the visual display adjustments are built-in standard operating systems features. "Adequate" to "substantial" access includes the capability to:

(a) define screen elements such as menu bars, icons, and cursor tracking;

(b) define color and contrast patterns;

(c) enlarge text and graphic elements on the screen; and

(d) toggle each of the access features on and off with an alert that indicates whether a feature is active.

Close View, which is a built-in access feature on the Macintosh, provides "adequate" access. Add-on screen enlargement programs with additional features provide "substantial" access.

The operating system adjustments discussed in this section may not carry-over into all applications and instructional software. If they do not, the application/instructional software must provide such adjustments themselves to provide "substantial" access.

User definable font, size, and screen elements such as menu titles, icons, and cursor track.
➢ Built-in for Windows95, Windows3.1, and Macintosh System 7.

User definable color/contrast.
➢ Built-in for Windows95, Windows3.1, and Macintosh System 7.

On and off toggle of adjustment features.
➢ Built-in for Windows95, Windows3.1, and Macintosh System 7.

3.2 Speech Output

Speech output refers to the ability to convert all visual information displayed on the monitor into audio output. Add-on screen readers serve this conversion.

It is important to distinguish between "talking software" applications and full accessibility using screen readers. An example of the first is an instructional software package which provides verbal directions for an on-screen activity or uses verbal reinforcement for correct responses, "good job", "you are correct", etc. In contrast, a screen reader can read all system icons, menu bars, system information, etc. and text generated through applications. While the first is important for instructional purposes, a screen reader is essential to full computer access.

Screen readers may be used in conjunction with other enhancement devices, such as magnification systems, or they may replace all visual output. Screen readers require a speech synthesizer which should have a volume control and headset jack. They may use a built-in speech synthesizer but a built-in speech synthesizer is not critical as long as an external

synthesizer can be installed. The availability of a standard RS232 serial port will guarantee that an external synthesizer can be attached.

Individuals using a screen reader need to have control over speech output in rate, volume, and pronunciations. They also must be able to select the information to be read based on its screen location, its position in a document, and to toggle on and off easily.

The Macintosh and Windows graphical user interfaces (GUI) have increased access barriers for people with a loss of vision. Current operating systems such as Windows 3.1, Windows 95 and Macintosh System 7.x and instructional software which use a graphical base do not contain the "hooks" that many current screen readers need to identify objects on the screen. While more sophisticated systems are being developed to deal with the current access issues, the industry is moving forward with a wider use of graphics and animation which create additional problems for screen readers.

Even with an operating system that effectively supports screen reader access, there is little assurance that software applications will mirror the same degree of compatibility. Be sure to evaluate the function of speech output with any applications and instructional software considered for purchase. "Substantial" access would be hardware and software with a proven track record of stable and complete speech output (as has been documented with many DOS-based programs). "Adequate" access would be hardware that supports the efficient operation of a speech output system and functional use of the operating system, application, and/or instructional software through speech output. It is currently unlikely that "substantial" access is available for many applications in a GUI environment.

Conversion of all critical visual information, text, and other visual images, to speech.
➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

Support of and compatibility with the user control features of speech output systems such as: user definable rate, volume, and pronunciation of speech output; user control of visual information to be "read" via pre-set and user defined parameters.
➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

On and off toggle of speech.
➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

3.3 TACTILE OUTPUT

Refreshable braille displays, Optacon II/inTouch, NOMAD, and other similar add-on devices display visual information via the tactile mode. Refreshable braille displays provide the braille equivalent of the information displayed on the computer monitor. The braille is presented one line at a time to correspond with the print information on the screen. Refreshable braille is produced through an add-on device attached to a port. An open serial port to attach the device would provide "adequate" access. Because the conversion of information from visual to tactile is analogous to a conversion from visual to speech, the difficulties with such conversions in a GUI are similar.

Conversion of all critical visual information and text to tactile.

➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

User control of visual information converted to tactile output via pre-set and user defined parameters.

➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

3.4 AUDITORY OUTPUT

The visual nature of computer output creates few access barriers for people who are hard of hearing or deaf. Most operating systems now include built-in features which provide visual alternatives for auditory signaling associated with computer functions.

"Adequate" access is the capacity of the computer to send a visual cue whenever the system beeps to indicate a system operation or an operator error. "Substantial" access would be the availability of student definable speech and audio output options with direct input into personal amplification devices to meet the needs of students who require enhanced audio output, e.g., a hard-of-hearing student whose reading skills to not allow for text use. In addition, "substantial" access would include the capacity to convert auditory information to text and graphics appropriate for the student's literacy level. In Windows 95 individuals can set a global "flag" to display visual feedback within software applications, in effect asking "cooperative" applications to display closed captions.

The current trend in instructional software, particularly CD-ROM programs, is to add speech and sound effects as critical operational features of the program. Without text subtitles and the capacity to enhance the auditory signals, individuals with hearing loss and other auditory information processing disabilities have major access barriers to such programs.

User definable volume and amplification.

➢ Built-in for Windows95, Windows3.1, and Macintosh System 7.

Conversion of all critical auditory information to text, graphics, etc. as appropriate.

➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

On and off toggle.

➢ Add-on for Windows95, Windows3.1, and Macintosh System 7.

3.5 HARD COPY OUTPUT

Many applications and instructional software programs include production of hard copy output as an integral part of the program. To be fully accessible, the hard copy output may need to be manipulated prior to printing or transformed into another format. Applications and instructional software with the ability to save text as an ASCII text file (which would support the production of braille and some other text alterations) would provide "adequate" access. "Substantial" access would add the ability to enlarge/enhance and manipulate the layout of the text and graphics in electronic form and to print at that same level of enhancement/alteration.

4.0 RELATED ACCESS

4.1 MATERIAL ACCESS

Documentation (manuals, supplemental print materials, etc.) must be accessible and available in well designed standard and alternative formats. Students with disabilities should have the same level of access to the documentation as students without disabilities.

"Adequate" access includes documentation which maximizes design elements such as clear print colors, sans serif fonts, charts and diagrams presented with redundant text, etc. "Substantial" access is documentation available in an electronic formats such as braille, ASCII, and or a disk equivalent.

NOTE: Because of past copyright restrictions, publishers were prohibited from making documentation available in electronic formats. H. R. 3754, recently passed at the federal level, negates these copyright restrictions.

4.2 FACILITY ACCESS

Not only must the computer systems themselves be accessible, but the areas in which they are used must also be accessible. Purchasing only the most accessible computer systems, then placing them in a lab on the third floor of a school without an elevator has negated the whole accessibility effort. Considerations for facility access include physical access to the equipment as well as communication access to the instructional support surrounding the equipment, e.g., placing the equipment in an environment that is so noisy that a person who is hard of hearing cannot hear instruction or talk with a lab assistant when they need help. "Adequate" to "substantial" access is the placement of the computer systems in facilities which meet the Americans with Disabilities Act Accessibility Guidelines. (ADAAG).

4.3 WORKSTATION ACCESS

Workstation access issues include the structures in which the computer systems are housed as well as other issues associated with the ergonomics of the systems environment. "Limited" access would be the purchase of workstations which have not been designed to meet the needs of students with disabilities. "Adequate" to "substantial" access occurs when careful thought is given to the individual needs of students with disabilities and those needs are addressed during all stages of planning and construction of the workstations.

In an accessible environment, students who use wheelchairs may need to position themselves differently to have access to the computers. This may mean that desks or tables need to have a higher leg clearance than for other students. Students who are hard of hearing may need assistive listening devices so they can hear the instruction of the teacher. Lighting in the room may need to be adjusted to reduce glare on the monitor. Many of these ergonomic considerations benefit all students, not just those with access needs.

4.4 VENDOR SUPPORT

With the addition of access features and applications to the basic system, incompatibilities are likely to occur. Product vendors, because of their knowledge of their products, may be crucial in

resolving compatibility issues. Given a choice of vendors, it is recommended that equipment and software be purchased from those vendors who are willing to develop collaborative relationships with the school and other vendors. As a result of these collaborative relationships, "adequate" to "substantial" access can occur with vendors who are willing to "tweak" systems, to provide equipment on a trial basis, to train staff, etc.

RESOURCES

BOOKS:

Alliance for Technology Access. (1994).
Computer resources for people with disabilities: A guide to exploring today's assistive technology. Alameda, CA: Hunter House Inc. Publishers

Church, G., & Glennen, S. (1992).
The handbook of assistive technology.
San Diego, CA: Singular Publishing Group, Inc.

Galvin, J.C., & Scherer, M.J. (1996).
Evaluating, selecting, and using appropriate assistive technology.
Gaithersburg, MD: Aspen Publishers, Inc.

NEWSLETTERS:

Closing the gap: Microcomputer technology for people with special needs.
PO Box 68, Henderson
MN 56044. 507-248-3294
($29.00 per year)

Enable.
Missouri Technology Center for Special Education
University of Missouri at Kansas City, 24 Education Bldg.
5100 Rockhill Rd.
Kansas City, MO 64110-2499.
800-235-1040 (Missouri only) or 816-235-1040 (no charge)
TechCtr@smtpgate.umkc.edu or
http://techctr.educ.umkc.edu/welcomepage

Innovations in Special Education.
Center for Innovations in Special Education
Parkade Center, Suite 152
601 Business Loop 70 W
Columbia, MO 65211.
800-976-2473 (Missouri only) or 573-884-7275 (no charge)

Just Use It.
Missouri Assistive Technology Project
4731 South Cochise, Suite 114
Independence, MO 64055-6975.
800-647-8557 or 816-373-5193 (no charge)
Internet: matpmo@9ni.com

COMPACT DISK:

ABLEDATA: Cooperative database distribution network for assistive technology.
Trace R & D Center
University of Wisconsin-Madison
S-151 Waisman Center
1500 Highland Avenue
Madison, WI 53705.
($50.00 for two-year subscription)
http://trace.wisc.edu

REQUIREMENTS FOR ACCESSIBLE SOFTWARE DESIGN

VERSION 1.1

MARCH 6, 1997

PURPOSE

The U.S. Department of Education considers universal accessibility to information a priority for all employees and external customers, including individuals with disabilities. The Department has established these Requirements for Accessible Software Design in order to support its obligation under Sections 504 and 508 of the Rehabilitation Act of 1973, 29 U.S.C. §§794 and 794d, as amended, to ensure the accessibility of its programs and activities to individuals with disabilities, specifically its obligation to acquire accessible electronic and information technology. Therefore, when selecting computer hardware and software applications for use within the Department's computing environment, the Department will evaluate the hardware and software to determine its accessibility by users with disabilities.

The purpose of this document is to convey the accessibility mneeds of the Department to the developers and suppliers of computer applications. It addresses the minimum accessibility requirements that software applications must meet in order to be used by all Department employees and customers. These requirements are offered to demonstrate the accessibility needs that must be considered when designing and developing software for the U.S. Department of Education. They address proven techniques for the design of universally accessible software that can be used by individuals with or without a disability. Software considered for use by the Department must execute in the standard operating environment at the time of offering and be compatible with the accessibility tools, both hardware and software, in use by individuals with disabilities at the Department.

While a product that meets these requirements ensures minimum accessibility for individuals with disabilities, the U.S. Department of Education encourages software and technology developers to be creative and maximize their design of software that is universally accessible. More specific recommendations for how to design universally accessible software can be obtained from the Assistive Technology Team in the Office of the Chief Information Officer (OCIO) Technology Center, (202) 708-7298 (voice); (202) 401-8510 (TTY); Internet: Joe_Tozzi@ed.gov

FUNCTIONAL SPECIFICATIONS

KEYBOARD ACCESS

1.) The software program must provide keyboard access to all functions of the application. All actions required or available by the program must be available with keystrokes (i.e., keyboard equivalents for all mouse actions including, but not limited to, buttons, scroll windows, text-entry fields and pop-up menus.)

2.) Clear and precise instructions for the use of all keyboard functions shall be provided as part of the user documentation.

3.) The software must have a logical tabbing order among fields, text boxes and focal points.

4.) The focus must follow the keystroke (e.g., using the arrow keys to navigate through a list followed by pressing the ENTER key or spacebar to select the desired item.

5.) The software shall not interfere with existing accessibility features built into the operating system, such as Sticky Keys, Slow Keys, Repeat Keys in Microsoft Windows 95.

6.) Avoid using timed responses if possible. If used, the ability to modify the timing parameter, by the individual user, is necessary.

7.) Selectable visual and auditory indication of key status for the Number Lock, Shift/Caps Lock, and Scroll Lock keys.

ICONS

1.) All icons shall have clear precise text labels included on the focus or provide a user-selected option of text-only buttons.

2.) The use of icons shall be consistent throughout the application.

3.) Provide pull-down menu equivalents for Icon functions (menu, tool and format bar).

4.) Provide keyboard access to all pull-down menus.

5.) Painted text is not accessible to all users. Use system text drawing tools so that screen reader software can interpret the text.

SOUNDS

1.) Provide a visual cue for all audio alerts.

2.) Support the Sounds feature where built into the operating system (such as Microsoft Windows 95 "show sounds" feature.)

3.) Allow the user to disable or adjust sound volume.

4.) Wherever and whenever information is presented in audio format, it shall be capable of being displayed by the user in text format, either as closed-captioning, a pop-up window, or other means, in parallel with the audio information.

DISPLAY

1.) Do not use color-coding as the only means of conveying information or indicating an action. Always provide an alternative or parallel method that can be used by individuals who do not possess the ability to identify colors.

2.) The application must support user-defined color settings system-wide. Highlighting should also be viewable with inverted colors.

3.) Do not use patterned backgrounds behind text or important graphics.

4.) Individual user override of application default fonts for printing and text displays are required.

5.) Allow user adjustment of, or allow user to disable flashing, rotating or moving displays to the extent that this does not interfere with the purpose of the application.

FIELD LABELING

1.) Position the descriptions or labels for data fields immediately next to the field, so that it is easy for screen-reading software, used by individuals that are blind, to associate the labels with the corresponding fields. The preferred position would be flush against the left side of the field with a colon (:).

DOCUMENTATION

1. Provide all manuals and documentation in electronic format as an ASCII text file. This should include including text descriptions of any charts and/or graphs or pictures or graphics of any nature. This is done to ensure that the information presented in charts or graphs is available to screen readers and/or in Braille versions of the text.

2.) Any reports that the application generates must be available in a "print to ASCII file" format.

COMMON ACCESSIBILITY AIDS

The U.S. Department of Education commonly uses, but is not limited to, the following assistive technology aids:

- ❑ Artic Technologies WinVision Screen Reading Software;
- ❑ AI Squared Zoom Text for Windows;
- ❑ Dragon Systems, Inc. DragonDictate Voice Recognition Software; and
- ❑ Productivity Plus Word Prediction Software.

REQUIREMENTS FOR ACCESSIBLE SOFTWARE DESIGN, Version 1.1 is available in alternate formats upon request by contacting the Technology Center at: 202/401-0028.